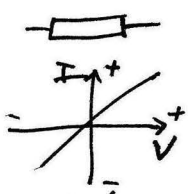
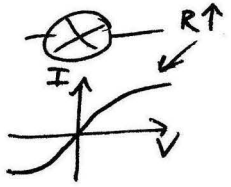
I-V characteristics

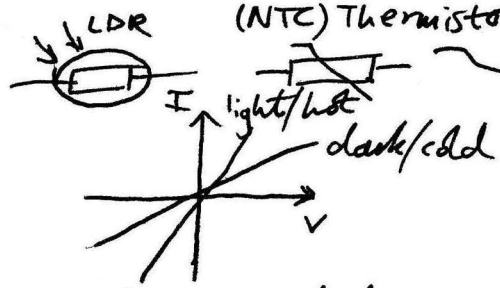


Resistor (Ohmic) constant R.

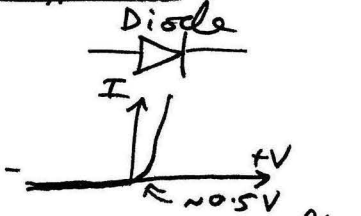


Filament (lamp) Non-ohmic

When current increased, frequency of collisions of electrons with ions in lattice increases, making them vibrate more, increasing temp, making collisions even more likely, so R↑.

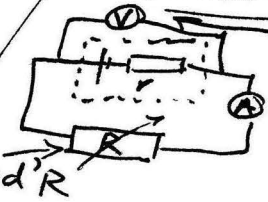


Both ohmic provided constant light intensity, temp. E in 'shakes' electrons loose to conduct (conduction band), R↓ ('Opposite to metal')

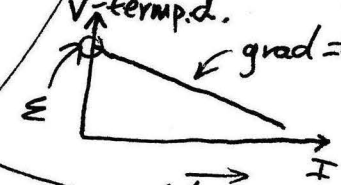


'Lets current only flow in one direction'. V high R in one direction, V low in other.

Internal Resistance



terminal p.d. (V available to circuit/load R after some of ℰ lost)



$\mathcal{E} = IR \quad Ir$

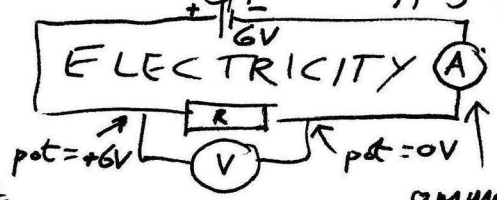
emf (total V supplied) — V 'lost' in battery

$(\mathcal{E} = V + Ir)$

$(\mathcal{E} = I(R+r))$

cell/battery/power supply: provides emf (ℰ) (electromotive force) → gives electrons energy

6V = 6J per Coulomb of charge/electrons



Resistor converts electrical E into thermal, due to its Resistance (Symbol: R, Unit: Ω)

Voltmeter goes 'across' component as it measures potential difference (p.d.) aka Voltage.

ammeter measures current (rate of flow of charge) Symbol: I Unit: A (amps)

$I = \frac{Q}{t}$

- Whole ℰ or V from battery must be 'used up' by circuit, so R gets all 6V.

$V = \frac{E}{Q}$ $\quad V = IR$ Ohm's law

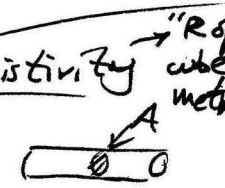
Power

$P = IV = I^2R = \frac{V^2}{R}$

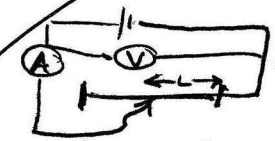
Resistivity

"R of cube metre"

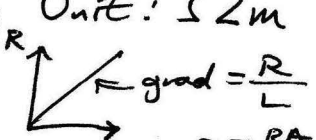
$R = \frac{\rho L}{A}$



Unit: Ωm



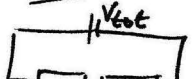
diameter ×2, A ×4, ∴ R↓ ÷4



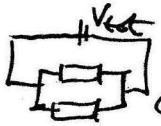
$\rho = \frac{RA}{L}$

∴ ρ = grad × A

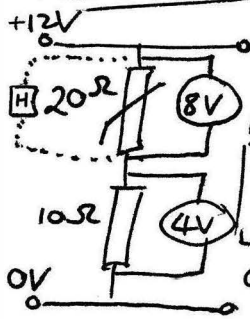
series (one loop) V_{tot} shared, same current.



Parallel (branches) Current shared, both have V_{tot}.



Potential Divider (2 resistors in series!)



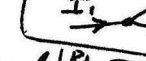
"Bigger R = bigger share of V_{tot}"

Ratio of R = Ratio of V

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$ AND $\frac{V_1}{V_{tot}} = \frac{R_1}{R_{tot}}$

Colder → R of therm ↑, so does V ↑ put heater across thermistor.

Kirchhoff's Laws: 1st: charge is conserved at junctions: e.g. $I_1 = I_2 + I_3$



$I_{tot\,in} = I_{tot\,out}$

2nd: sum of ℰ = sum of p.d. 'drops' in any closed loop.

ℰ = 3V

$\frac{1}{R_{tot}} = \frac{1}{R_1} + \frac{1}{R_2}$

* If same, R_{tot} is half!